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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/854,924	05/14/2001	Toshihisa Yokoyama	782_163	7936
25191	7590	05/28/2004	EXAMINER	
BURR & BROWN PO BOX 7068 SYRACUSE, NY 13261-7068			SONG, MATTHEW J	
			ART UNIT	PAPER NUMBER

1765

DATE MAILED: 05/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/854,924

Applicant(s)

YOKOYAMA ET AL.

Examiner

Matthew J Song

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 and 28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 and 28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/17/2004 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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3. Claims 1-9 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Imaeda et al (JP 10-265293), where an English Abstract and English computer translation (CT) are provided, in view of Shudo et al (US 4,264,407) or Ciszek et al (US 4,075,055) or Yamauchi et al (JP 61-291487), an English Abstract has been provided.

Imaeda et al discloses a melting a raw material of an oxide single crystal in a crucible 7 (CT [0039]); contacting a seed crystal 15 to a melt of the raw material; drawing the melt from an opening of the crucible by pulling down the seed crystal 15 (CT [0008] and [0029]); providing a first heater 3,4 around the opening of the crucible; growing an oxide single crystal 14; and providing a second heater 12A, 12B around the opening of the crucible. Imaeda et al discloses forming a single crystal fiber or plate (CT [0015]), this reads on applicant's planar form. Imaeda et al also discloses a nozzle 13 provided at the tip of the crucible 7 (Fig 1). Imaeda et al also discloses the temperature gradient in the single crystal growth section was able to be controlled to 10-150°C/mm (CT [0039]) and the temperature gradient of the single crystal growth section 18 neighborhood could be controlled by the electric power supply to the nozzle section 13 and generation of heat of an after heater (CT [0038]), this reads on applicant's temperature gradient within a distance of 1 mm from the opening of the crucible is 100°C/mm or more because the nozzle temperature and after heater temperature are controlled to produce a temperature gradient of 150°C/mm in the crystal growth section and the nozzle is inherently within 1 mm of the opening.

Imaeda et al does not disclose a cooling mechanism for directly cooling the oxide single crystal while the oxide single crystal is being drawn from the opening of the crucible.

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In a method of cooling crystal ribbons, note entire reference, Shudo et al teaches a cooling means may comprise a conduit and plurality of nozzles, through which a gaseous medium is blown over the surface of the grown crystal (col 6, ln 65-68), this reads on applicant's direct cooling only the single crystal, and the cooling rate may be easily be changed during the operation by varying the flow rate of the gaseous medium and the distance between the nozzles and the surface (col 3, ln 60-68 and col 5, ln 65 to col 6, ln 5). Shudo et al also discloses heaters 13, 19 before and after the cooling mechanism 9 (Fig 1a). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Imaeda et al with Shudo et al's cooling mechanism to increase the temperature gradient in the solid-liquid interface by cooling the grown crystal, which is desirable, as evidenced by Mimura et al (US 4,367,200).

In a method of growing a crystal ribbon from a die, Ciszek et al teaches for wider ribbons of greater than 4 centimeters auxiliary cooling techniques are required to assure he desired temperature distribution across the crystal at the solid liquid interface during growth, where cooling is achieved by directing a flow of inert gas in different controlled amounts to different segments of the liquid solid crystal interface so as to maintain the desired growth temperature across the growing body's interface (col 5, ln 1-40), this reads on applicant's cooling mechanism for directly cooling the oxide single crystal while the oxide single crystal is being drawn from the opening. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Imaeda et al with Ciszek et al's cooling mechanism to increase the temperature gradient in the solid-liquid interface by cooling the grown crystal, which is desirable, as evidenced by Mimura et al (US 4,367,200).

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In a method of crystal growth, note entire reference, Yamauchi et al teaches gas supply ports are provided at the melt outlet, this reads on applicant's within 1 mm, and cooled inert gas is blown to give a stepper temperature gradient and further improve the stability of the interface between solid and liquid (Abstract). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Imaeda et al with Yamauchi et al's cooling mechanism to increase the temperature gradient, which improves the stability of the interface between solid and liquid.

The combination of Imaeda et al and Shudo or the combination of Imaeda et al and Ciszek et al or the combination of Imaeda et al and Yamauchi et al is silent to the cooling mechanism and the second heater are substantially co-linear with respect to one another along the direction in which the oxide single crystal is drawn. Shudo et al teaches the cooling rate may easily be changed during the operation by varying the distance between the nozzles and the melt surface (col 5, ln 65 to col 6, ln 5). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify combination of Imaeda et al and Shudo or the combination of Imaeda et al and Ciszek et al or the combination of Imaeda et al and Yamauchi et al by optimizing the distance of the nozzles of the cooling mechanism with the melt surface to obtain a co-linear heater and cooler arrangement by conducting routine experimentation of a result effective variable (MPEP 2144.05).

Referring to claim 2, the combination of Imaeda et al and Shudo or the combination of Imaeda et al and Ciszek et al teaches cooling, where cooling inherently removes ambient heat.

Referring to claim 3, the combination of Imaeda et al and Shudo or the combination of Imaeda et al and Ciszek et al teaches a flow of inert gas.

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Referring to claim 4-5, the combination of Imaeda et al and Shudo or the combination of Imaeda et al and Ciszek et al teaches a nozzle at the tip of a crucible.

Referring to claim 6-9, the combination of Imaeda et al and Shudo or the combination of Imaeda et al and Ciszek et al teaches a fiber, this reads on applicant's planar form.

Referring to claim 28, the combination of Imaeda et al and Shudo or the combination of Imaeda et al and Ciszek et al teaches a heating means **12A, 12B**, which is located in close proximity to the oxide crystal, therefore reads on applicant's directly heating the oxide single crystal.

4. Claims 1-9 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mimura et al (US 4,367,200) in view of Shudo et al (US 4,264,407).

Mimura et al discloses an oxide single crystal manufacturing method (col 5, ln 35-40) comprising the step of melting a raw material in a crucible **2** (col 2, ln 50-65), contacting a seed crystal and lowering a growing crystal using rollers **13**, this reads on applicant's pulling down the seed crystal (col 5, ln 15-20 and col 2, ln 60-65). Mimura et al also discloses employing a cooling liquid or like means for cooling the grown crystal to increase the temperature gradient in the solid-liquid interface (col 4, ln 20-25). Mimura et al also teaches a nozzle part **8** and growing fibrous or ribbon-like single crystals, this reads on applicant's planar form (col 6, ln 1-5 and col 3, ln 55-60). Mimura et al also teaches the tip of the nozzle part **8** is given a very steep thermal gradient and the molten liquid is cooled into a single crystal (col 3, ln 1-10), this reads on applicant's temperature gradient within in 1 mm of the opening of the crucible.

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Mimura et al discloses a means for cooling the grown crystal. Mimura et al does not disclose a cooling mechanism for directly cooling the single crystal.

In a method of cooling crystal ribbons, note entire reference, Shudo et al teaches a cooling means may comprise a conduit and plurality of nozzles, through which a gaseous medium is blown over the surface of the grown crystal (col 6, ln 65-68), this reads on applicant's direct cooling only the single crystal, and the cooling rate may easily be changed during the operation by varying the flow rate of the gaseous medium and the distance between the nozzles and the melt surface (col 3, ln 60-68 and col 5, ln 65 to col 6, ln 5). Shudo et al also discloses heaters **13**, **19** before and after the cooling mechanism **9** (Fig 1a), where heater **19** reads on applicant's second heater. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Mimura et al with Shudo et al's cooling mechanism with heaters to increase the temperature gradient in the solid-liquid interface by cooling the grown crystal, which is desirable, as evidenced by Mimura et al (US 4,367,200).

The combination of Mimura et al and Shudo is silent to the cooling mechanism and the second heater are substantially co-linear with respect to one another along the direction in which the oxide single crystal is drawn. Shudo et al teaches the cooling rate may easily be changed during the operation by varying the distance between the nozzles and the melt surface (col 5, ln 65 to col 6, ln 5). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify combination of Mimura et al and Shudo by optimizing the distance of the nozzles of the cooling mechanism with the melt surface to obtain a co-linear heater and cooler arrangement by conducting routine experimentation of a result effective variable (MPEP 2144.05).

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The combination of Mimura et al and Shudo teaches a steep temperature gradient but is silent to the temperature gradient is 100°C/mm or more. The temperature gradient during crystal growth is well known in the art to be a result effective variable and a gradient of 100°C/mm or more is also known, as evidenced by Imaeda et al (JP 10-265293) above. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Mimura et al and Shudo by optimizing the temperature gradient by conducting routine experimentation of a result effective variable.

Double Patenting

5. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. Claims 1-9 and 28 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 3, 13, 22 and 26 of U.S. Patent No. 6,565,654 in view of Shudo et al (US 4,264,407) and Imaeda et al (JP 10-265293), where an English Abstract and English computer translation (CT) are provided. Although the conflicting claims are not identical, they are not patentably distinct from each other because US 6,565,654

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claims a process for producing a planar body of an oxide single crystal comprising the steps of melting a raw material in a crucible, contacting a seed crystal, pulling down the seed crystal, a plurality of heaters are provided in position facing the nozzle and a plurality of devices for supplying a cooling medium in a position facing a nozzle. US 6,565,654 does not claim the cooling medium directly cools the single crystal. Shudo et al teaches a method of growing crystal ribbons using a cooling means comprising a plurality of nozzles through which a gaseous medium is blown over the surface of the grown crystal, this reads on directly cooling (col 3, ln 60-67) and a second heater **19**. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify US 6,565,654 with Shudo et al's direct cooling to remove heat effectively, thereby improving productivity ('407 col 2, ln 20-35).

The combination of US 6,565,654 and Shudo et al does not teach the temperature gradient within 1 mm of the opening of the crucible is 100°C/mm or more.

Imaeda et al discloses a melting a raw material of an oxide single crystal in a crucible **7** (CT [0039]); contacting a seed crystal **15** to a melt of the raw material; drawing the melt from an opening of the crucible by pulling down the seed crystal **15** (CT [0008] and [0029]). Imaeda et al also discloses a nozzle **13** provided at the tip of the crucible **7** (Fig 1). Imaeda et al also discloses the temperature gradient in the single crystal growth section was able to be controlled to 10-150°C/mm (CT [0039]) and the temperature gradient of the single crystal growth section **18** neighborhood could be controlled by the electric power supply to the nozzle section **13** and generation of heat of an after heater (CT [0038]), this reads on applicant's temperature gradient within a distance of 1 mm from the opening of the crucible is 100°C/mm or more because the nozzle temperature and after heater temperature are controlled to produce a temperature gradient

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of 150°C/mm in the crystal growth section and the nozzle is inherently within 1 mm of the opening. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of US 6,565,654 and Shudo et al by using the temperature gradient taught by Imaeda et al because rapid cooling prevents segregation (CT [0019]).

The combination of US 6,565,654, Shudo et al and Imaeda et al does not teach the cooling mechanism and second heater are substantially co-linear with respect to one another along the direction in which said oxide single crystal is drawn. Shudo et al teaches the cooling rate may easily be changed during the operation by varying the distance between the nozzles and the melt surface (col 5, ln 65 to col 6, ln 5). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify combination of US 6,565,654, Shudo et al and Imaeda et al by optimizing the distance of the nozzles of the cooling mechanism with the melt surface to obtain a co-linear heater and cooler arrangement by conducting routine experimentation of a result effective variable (MPEP 2144.05).

Response to Arguments

7. Applicant's arguments with respect to claims 1-9 and 28 have been considered but are moot in view of the new ground(s) of rejection.

8. Applicant's arguments filed 3/17/2004 have been fully considered but they are not persuasive.

Applicants' argument that Imaeda et al does not teach a temperature gradient within a distance of 1 mm from the opening of the crucible is noted but is not found persuasive. Imaeda et

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al teaches a single crystal growth section 18 of the nozzle section has a temperature gradient of 10-150°C/mm (CT [0039]). Imaeda et al also teaches the temperature gradient is controlled by the electrical power supplied to the nozzle (CT [0038]), which reads on applicants' within 1 mm of the opening because the nozzle is 0 mm from the opening since it is the opening. Therefore, Imaeda et al does teach controlling the temperature gradient within 1 mm of the opening of the crucible.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

